

Claims

1. A voltage regulator for supplying a low current load with a more regulated voltage supply and a high current load with a less regulated voltage supply comprising:

transistor regulation means for providing a coarse level of voltage regulation to a common supply voltage delivered to a high current load, said transistor regulation means including a control gate; and

feedback regulation means for providing a fine level of regulation to said common supply voltage delivered to a low current load, the feedback means having an output line coupled to said control gate of the transistor means whereby the output level of the feedback means influences said transistor means.

2. The voltage regulator of claim 1 wherein said transistor regulation means comprises a depletion NMOS transistor with source and drain electrodes connecting the common supply voltage to the high current load.

3. The voltage regulator of claim 1 wherein the feedback regulation means comprises a bandgap regulator feeding a comparator and an output transistor, the output transistor connected to the common supply and to a voltage divider having a loop back to the comparator.

4. The voltage regulator of claim 3 wherein the output transistor is connected to said output line coupled to said control gate of the transistor means.

5. A voltage regulator for supplying a low current load with a more regulated voltage supply and a high current load with a less regulated voltage supply comprising:

a first input terminal connected to a common voltage supply, the input terminal connected to a bandgap reference circuit feeding a comparator with an output line communicating with a voltage divider, the voltage divider having a first connection to the low current load and a second connection as a feedback path to the comparator, the comparator driving a current sinking transistor having an electrode connected to the common voltage supply and another electrode connected to the feedback path associated with the voltage divider; and
a second input terminal connected to the common voltage supply which, in turn, is connected to an MOS transistor having a gate connected to the low current load, the MOS transistor having an electrode connected to the high current load whereby the first and second current loads are supplied current from the same common voltage supply but with different voltage regulation.

6. The voltage regulator of claim 5 wherein the high current load comprises a serially connected string of capacitors associated with a charge pump.

7. The voltage regulator of claim 5 wherein the low current load comprises a plurality of clock circuits associated with a charge pump.

8. A voltage regulator comprising:

a first regulator stage having a voltage reference circuit connected to a common supply voltage, the reference circuit having a first leg feeding a comparator as a first input and a voltage divider connected to the common supply with a tap feeding back to the comparator in a second leg as a second input, the comparator having an output operating a first current driver device connected to the common supply in feedback relation to the comparator through the voltage divider, the first current driver device having a first output line carrying a first output voltage and a first current;

a second current driver device connected to the common supply voltage and operable as a voltage clamp in response to said first output voltage, thereby acting as a second regulator stage, in parallel with the first regulator stage, the second current driver device having a second output line carrying a second output voltage, less than the common supply voltage, and a second current;

a first load connected to the first output voltage and to the voltage divider of the first regulator stage;

a second load connected to the second output voltage of the second regulator stage and to the voltage divider;

whereby the first and second regulator stages stabilize voltage variations in the first and second loads.

9. The voltage regulator of claim 8 wherein the first load comprises an oscillator having a low voltage pulse train output signal.

10. The voltage regulator of claim 8 wherein the second load comprises a series of capacitors in a charge pump.

11. The voltage regulator of claim 8 wherein said voltage reference circuit is a bandgap reference.

12. The voltage regulator of claim 8 wherein the first current driver device is a transistor having a source connected to the common supply voltage, a gate connected to the comparator and a drain connected to said voltage divider using said first output line.

13. The voltage regulator of claim 8 wherein the second current driver is a depletion NMOS transistor with a first electrode connected to the common supply voltage, a gate electrode connected to the first output line of the first current driver device and a second electrode connected to the second output line.

14. The voltage regulator of claim 8 wherein the voltage divider comprises first and second resistors connected in series, the connection of said resistors being said tap.

15. The voltage regulator of claim 14 wherein said first and second resistors are matched.

16. A voltage regulator in a charge pump circuit comprising:

a first regulator stage connected to a common supply and having a feedback loop in relation to a voltage comparator with an output line driving an oscillator producing a low voltage pulse train; and

a second regulator stage connected to a common supply and having a voltage clamp in parallel to said feedback loop with an output line driving a series arrangement of clock circuits with associated capacitors in a phased relation stepping the common supply voltage to a higher level.

17. The voltage regulator of claim 16 wherein the first regulator stage comprises said comparator and an output transistor, the output transistor having an output electrode communicating with the second regulator stage and with the comparator.

18. The voltage regulator of claim 17 further comprising a voltage divider network connected to the output electrode of the output transistor.

19. The voltage regulator of claim 18 wherein the voltage divider network comprises a matched pair of transistors.

20. The voltage regulator of claim 16 wherein a bandgap regulator is connected between the common supply and the voltage comparator.